

UNITED NATIONS OFFICE FOR OUTER SPACE AFFAIRS

Education Curriculum on Space Law



UNITED NATIONS



Contents

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Contents

Abbreviations and acronyms

Preface

Introduction

Module 1. Basic concepts of international law and space law

Module 2. International law and other regulations applicable to remote sensing, geographic information systems, satellite meteorology and global climate activities

Module 3. Satellite communications and applicable international law and other regulations

Module 4. Global navigation satellite systems and applicable international law and other regulations

List of instruments of international law

Abbreviations and acronyms

The following abbreviations and acronyms appear in this publication:

Arabsat	Arab Satellite Communications Organization	IAF	International Astronautical Federation
CBERS	China-Brazil Earth Resources Satellite	IAU	International Astronomical Union
CEOS	Committee on Earth Observation Satellites	ICAO	International Civil Aviation Organization
CGSIC	Civil Global Positioning System Service Interface Committee	ICG	International Committee on Global Navigation Satellite Systems
CONAE	Comisión Nacional de Actividades Espaciales	ICJ	International Court of Justice
COSMO-SkyMed	Constellation of small satellites for the Mediterranean basin observation	IGO	Intergovernmental organization
COSPAR	Committee on Space Research	ILA	International Law Association
COPUOS	United Nations Committee on the Peaceful Uses of Outer Space	IMO	International Maritime Organization
DBS	Direct broadcast satellite	IMSO	International Mobile Satellite Organization
DMC	Disaster Monitoring Constellation	INMARSAT	International Maritime Satellite Organization
DoT	United States Department of Transportation	INSPIRE	Infrastructure for Spatial Information in Europe
EC	European Commission	INTELSAT	International Telecommunications Satellite Organization
EGNOS	European Geostationary Navigation Overlay Service	INTERSPUTNIK	International Organization of Space Communications
ESA	European Space Agency	ISRO	Indian Space Research Organization
EU	European Union	ITAR	United States International Traffic in Arms Regulations
EUTELSAT	European Telecommunications Satellite Organization	ITSO	International Telecommunications Satellite Organization
FAA—WAAS	Federal Aviation Administration—Wide Area Augmentation System	ITU	International Telecommunication Union
GAGAN	GPS Aided Geo-Augmented Navigation System	JAXA	Japan Aerospace Exploration Agency
GATS	General Agreement on Trade in Services	LEO	Low Earth Orbit
GEO	Group on Earth Observations	OOSA	United Nations Office for Outer Space Affairs
GIS	Geographic Information System	RS	Remote Sensing
GLONASS	Global Navigation Satellite System	SPOT	Spot Image
GMES	Global Monitoring for Environment and Security	UNESCO	United Nations Educational, Scientific and Cultural Organization
GMPCS	Global Mobile Personal Communication Services	UNGA	United Nations General Assembly
GNSS	Global Navigation Satellite Systems	UNISPACE III	Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space
GPS	Global Positioning System	UN-SPIDER	United Nations Platform for Space-based Information for Disaster Management and Emergency Response
GSO	Geostationary Satellite Orbit	UNTS	United Nations Treaty Series
IAA	International Academy of Astronautics	WMO	World Meteorological Organization

Preface

Capacity-building, training and education in space law are of paramount importance to national, regional and international efforts to further develop space activities, in particular with regard to promoting broader understanding and acceptance of the international legal framework that governs the conduct of space activities. The need to build indigenous capacity in space law and policy was recognized by the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE III) and emphasized in the strategy of the Committee on the Peaceful Uses of Outer Space to further implement the recommendations of UNISPACE III.

One of the pillars that support the development of legal and policy frameworks at the national level is the availability of professionals able to provide services in that field. Promoting education in space law is therefore included in the programme of the Office for Outer Space Affairs to build capacity in space law.

In 2007, the Committee on the Peaceful Uses of Outer Space and its Legal Subcommittee requested the Office for Outer Space Affairs to explore the possibility of developing a curriculum for a basic course on space law that could

be used, in particular for the benefit of developing countries, in the activities of the regional centres on space science and technology education affiliated to the United Nations. Consequently, the first United Nations Expert Meeting on Promoting Education in Space Law was held in Vienna on 3 and 4 December 2007.

The Group of Experts continued to work on the curriculum over subsequent years by electronic means and, when possible, on the margins of other international space-related meetings and workshops. A first draft of the curriculum was circulated for comments in the Legal Subcommittee in 2009, and a second draft was circulated in 2011. The final step of harmonizing the content of the modules for consistency was completed in 2013.

Although the curriculum has been developed to support the activities of the regional centres on space science and technology education affiliated to the United Nations, it has been structured in such a manner that it can also serve as an educational tool for other educational institutions and training initiatives. The curriculum is complemented by an online compilation of supplemental reference materials, available on the website of the Office for Outer Space Affairs. ■

Introduction

This curriculum on space law is designed to be an efficient and flexible tool for global capacity-building on the beneficial uses of outer space and the law applicable thereto. Space-based technologies are instrumental in every country and on every continent as a crucial aspect of a country's infrastructure. Knowledge of the legal framework for these technologies provides a deeper understanding of the roles that space, technology and law play in an increasingly interdependent world. Raising awareness and building regional capacity in the knowledge and application of space law furthers orderly international development and cooperation.

In particular, as space activities and their applications are developed, it is crucial to understand, at least on a general level, how law and regulation interact with such developments. Existing laws and regulations can both be used to further the use of beneficial applications and international cooperation in this context, and to lay out certain conditions or guidelines for them. In both cases it is important to establish an understanding of the law, legal approaches and legal thinking as early as possible, as mid-course corrections in projects are always far more costly in terms of time, effort and funds than acquiring prior knowledge of the legal parameters for the project at hand.

Likewise, a general understanding of what space law is and how it works can be very helpful in developing new legal or semi-legal (policy, guideline, recommendatory) tools to help fully realize the benefits that space activities and their applications can bring to society. Though lawyers may be needed in the end to draft legislation

and regulations related to space activities, inputs are needed from the scientific, technical, operational and political communities so that the realities behind space activities and their applications are properly taken into account.

Regional centres for space science and technology education

The Regional Centres for Space Science and Technology Education (hereafter “the Regional Centres”) were established in response to United Nations General Assembly (UNGA) resolution 45/72 of 11 December 1990. To date, five regional centres, affiliated to the United Nations, have been established in Africa (Morocco, Nigeria), Asia and the Pacific (India), Western Asia (Jordan) and Latin America and the Caribbean (campuses in Brazil and Mexico). In addition, plans for establishing a regional centre at Beihang University in Beijing are currently under way.

The Regional Centres use existing educational facilities and build upon expertise already available throughout educational and other research institutions in their regions to develop, through in-depth education, indigenous capability for research and applications. Currently the Regional Centres offer nine-month postgraduate courses in the following core disciplines: Remote Sensing and Geographic Information Systems (RS and GIS), Satellite Communication (SATCOM), Satellite Meteorology and Global Climate (SATMET), Space and Atmospheric Sciences and Data Management, and Global Navigation Satellite Systems.

Curriculum on education in space law

The curriculum for a basic course in space law, to be integrated into the education programmes of the five Regional Centres, has been developed by a group of distinguished educators and experts on space law, in consultation with the Directors and Secretary-General of the Regional Centres. The development process was coordinated by the United Nations Office for Outer Space Affairs (OOSA).

The current programme of education offered by the Regional Centres was considered as a starting point in the development of the course structure on space law, in order to ensure that the end product would complement and support the work already being done at the Regional Centres. Common challenges and impediments faced by the Regional Centres were also kept in mind throughout the process.

The curriculum is designed to be used by instructors as a reference guide and flexible syllabus in their educational programme, with a view to enhancing capacity-building on the beneficial uses of outer space and space technologies. The curriculum will complement the work which is already being done at the Regional Centres by raising awareness on space law and the regulatory aspects relating to the conduct of space activities, for the benefit of students at the Regional Centres.

Basic structure of the curriculum

The curriculum on space law consists of four complementary modules. Each of the four modules is divided in five classes. Table 1 below provides a general schematic overview of the modules and classes. A proposed outline of activities

is provided for each module, and a more detailed breakdown of the topics to be covered is reflected separately for each class.

The first module, “Basic concepts of international law and space law”, provides an introduction to the legal regime governing the conduct of space activities. The first module is a prerequisite for the three subsequent modules and should be offered to all students, as it gives a foundation for understanding specific applications of space law throughout the subsequent modules. In turn, the three latter modules are designed to complement existing and planned education programmes of the regional centres, namely remote sensing and GIS, satellite meteorology and global climate; satellite communication and data management; and Global Navigation Satellite Systems (GNSS).

Modules

Each module begins with an “Introduction” of the topic at hand and its connection to international law and the space law regime. Next, a “Module Objective” is provided to identify the main areas of study during the module. The purpose of the “Learning Outcomes” is to identify, from the learner’s perspective, what he or she will learn in each module. The section on “Module Design” gives the instructor a suggested scheme for time management, while at the same time leaving the instructor with the flexibility to make the maximum use of local resources. It is suggested that lectures can be augmented or substituted with guest lecturers, tutorials, practical exercises, etc. At the end of each module, a follow-up section will provide the instructor with examples of questions that can be used by students to test their knowledge of the most relevant aspects of the module. Suggested topics for students interested in further study are also provided as applicable.

Classes

Each module consists of five classes. The topics to be covered are described in some detail under the respective classes. The section on “Learning Outcomes” will again identify, from the learner’s perspective, what he or she will learn in that particular class. A list of materials to support the studies, including relevant

treaties, General Assembly resolutions and websites of actors mentioned during the class, is provided for each class. Whenever possible, online resources have been provided. A compilation of supplemental materials, including lists of monographs, articles and other materials, in all official languages of the United Nations whenever possible, has been made available and is regularly updated on the OOSA website. ■

Table 1. Schematic overview of the space law curriculum

	Module 1 Basic concepts of international law and space law	Module 2 Remote sensing/GIS, satellite meteorology and global climate + international law	Module 3 Satellite communications + international law	Module 4 Global navigation satellite systems (GNSS) + international law
Class 1	Introduction to international law	International law relating to remote sensing	Overview of international law on satellite communications	International institutional context for GNSS operations
Class 2	The Outer Space Treaty and the fundamental principles of space law	National legislation for remote sensing	Overview of international law on satellite communications	GNSS providers and GNSS augmentation
Class 3	Other space treaties and General Assembly resolutions	Regional and global agreements on remote sensing	Technical standards and national licensing	GNSS users
Class 4	National regulations, commercialization and privatization	Bilateral and multilateral agreements on remote sensing	International trade in satellite communication services and global mobile personal communication services	Legal framework for GNSS services
Class 5	Multilateral and bilateral agreements and intergovernmental organizations	Sources of remote sensing data	Satellite broadcasting	GNSS services, uses and current problems
Duration	2 weeks/12 hours	2 weeks/10 hours	2 weeks/11 hours	2 weeks/10 hours

Module 1. Basic concepts of international law and space law

Introduction

Space law can be described as the body of law applicable to and governing space-related activities. Space law, much like general international law, comprises a variety of international agreements, treaties, conventions, and United Nations General Assembly resolutions, as well as rules and regulations of international organizations. The term “space law” is most often associated with the rules, principles and standards of international law appearing in the five international treaties and five sets of principles governing outer space which have been developed under the auspices of the United Nations. In addition to these international instruments, many States have national legislation governing space-related activities.

The primary goals of space law are to ensure a rational, responsible approach to the exploration and use of outer space for the benefit and in the interests of all humankind. To this end, space law addresses a variety of matters, such as the preservation of the space and Earth environment, liability for damages caused by space objects, the settlement of disputes, the protection of national interests, the rescue of astronauts, the sharing of information about potential dangers in outer space, the use of space-related technologies, and international cooperation. The various instruments of space law set out a number of fundamental principles to guide the conduct of space activities, including the notion of space as the province of all humankind, the freedom of exploration and use of outer space by all states without discrimination, and the principle of non-appropriation of outer space. It is through these



instruments that States cooperate to ensure a sustainable use of outer space that benefits all countries.

Space law has developed over time and will continue to develop as new challenges arise. Familiarity with the basics of international law in general, and with the main legal instruments and principles of space law in particular, will be essential when responding to these new challenges with applications of space technologies and through international cooperation in the space arena.



Module objective

This module provides students with a basic reference framework for understanding legal principles and rules as well as fundamental legal issues pertaining to space activities. Students are familiarized with the key concepts, terminology and constructs of both international law and international space law as a specialized subdomain of international law. The module therefore deals with two main aspects: firstly, “International law”, which is considered in the first class, and secondly, “The legal regime governing the conduct of space activities”, covered in the remaining four classes.



Learning outcomes

1. **Awareness of how international law deals with space activities and space applications.**
2. **Awareness of the main structure and elements of international space law.**
3. **Awareness of the roles of national governments and international organizations in the regulation of space activities and space applications.**



Module design

The module consists of five classes of two hours each, with the exception of classes 1 and 3 (see table 2). The classes should consist of approximately 90 minutes of instruction, followed by at least 30 minutes for questions and discussion.

The class-specific programme can focus on those topics, issues and areas that are most relevant to the audience. At the end of each class description, students are given a list of reading materials to support their studies. For easy access to resources and references, most materials in the reading list are available online. Given the importance of the first module as a foundation for understanding specific applications of space law throughout the subsequent modules, it is recommended that additional materials which can be found on the OOSA website also be used.

The suggested schedule for this module includes two hours of tutorials, and therefore the time allotted for classes 1 and 3 is three hours. Module 1 does not include practical exercises.

Table 2. Breakdown of module 1 by topic and activity

Class	Topic	Activity (hours)		
		L	T+P	Total
1	Introduction to international law	2	1	3
2	The Outer Space Treaty and the fundamental principles of space law	2	0	2
3	Other space treaties and the General Assembly resolutions relevant to outer space	2	1	3
4	National regulations, commercialization and privatization	2	0	2
5	Multilateral and bilateral agreements and intergovernmental organizations	2	0	2
Total		10	2	12

Note: L = lectures; T+P = tutorials and practical exercises.

Class 1. Introduction to international law



Topics to be covered

Basic concepts of international law

- What is law?
 - ...❖ Role of law in reflecting moral and ethical principles and in introducing predictability into human action
 - ...❖ Public international law
 - ...❖ Private international law
 - ...❖ Relationship of international law and national law
- Subjects of international law
 - ...❖ States
 - ...❖ Intergovernmental organizations as means for international cooperation
- Sources of international law
 - ...❖ Treaties
 - Charter of the United Nations
 - Vienna Convention on the Law of Treaties (containing rules on the conclusion, interpretation, validity, ending and suspension of treaties)
 - Other multilateral and bilateral treaties
 - ...❖ Customary international law
 - ...❖ General principles of law
- Sovereignty and jurisdiction
- Responsibility of States and liability for damage

Learning objective

Upon completion of the class, students will be familiar with the fundamental principles of international law and with the legal regime governing the conduct of space activities in particular. Students will also understand the contribution that international law can make to the preservation of outer space for humankind and to the use of space for peaceful purposes.

The first class will provide students with insight into the role of international law in reflecting moral and ethical principles as well as in introducing predictability into human action; the characteristics of and the distinction between public and private international law; and the relationship between international law and national law.

Students are introduced to States and intergovernmental organizations as the legal subjects of international law and to the legal parameters for their actions. Students will become familiar with the main sources of international law, in particular international treaties such as the Charter of the United Nations and the Vienna Convention on the Law of Treaties, with the concept of customary international law and with general principles of law.

Finally, students are introduced to ideas about how the key aspects of statehood, such as sovereignty and jurisdiction, play a fundamental role in international law. Students are also introduced to the concepts of international responsibility of States for their activities and liability for damage caused by such activities.

In conclusion, the class will provide students with the fundamental legal tools to understand the structure of international law and its impact on the conduct of space activities. With this foundation, students will be able to understand the

contribution that international law can make to the preservation of outer space for mankind and for peaceful purposes.

References and resources

References

- Charter of the United Nations
<http://treaties.un.org/doc/Publication/CTC/uncharter.pdf>
- Vienna Convention on the Law of Treaties
<http://legal.un.org/avl/ha/vclt/vclt.html>

Online resources

- Description of public international law
http://en.wikipedia.org/wiki/Public_international_law
- Max Planck Encyclopedia of Public International Law
<http://www.mpepil.com>
- Institute of Advanced Legal Studies
http://ials.sas.ac.uk/library/guides/research/res_public.htm
- Columbia University, Arthur W. Diamond Law Library Research Guides, “Researching Public International Law”
http://library.law.columbia.edu/guides/Researching_Public_International_Law

Class 2. The Outer Space Treaty and the fundamental principles of space law



Topics to be covered

The legal regime governing the conduct of space activities

- International treaties
 - ❖ Outer Space Treaty
- Fundamental principles of space law
 - ❖ Province of all mankind
 - ❖ “Taking into account, in particular, the needs of developing countries”
 - ❖ Freedom of exploration and use without discrimination of any kind
 - ❖ Non-appropriation
 - ❖ Application of the United Nations Charter and general international law
 - ❖ Partial de-weaponization of outer space and demilitarization of celestial bodies
 - ❖ Responsibility of States for governmental and non-governmental space activities
 - ❖ Liability for damage caused by space objects
 - ❖ Due regard to the corresponding interest of all States
 - ❖ Duty to provide information on and to register space objects

Learning objective

The second class provides students with an overview and discussion of the most important international treaty governing the conduct of space activities, namely the 1967 Outer Space Treaty.

Following an overview of the background and genesis of the Outer Space Treaty, students will gain insight into its main articles and clauses, establishing the fundamental elements of international space law. The way in which international responsibility of States functions in the context of outer space and space activities will also be discussed.

Upon completion of the class, students will be familiar with the concept of “province of all mankind” as it relates to such other concepts as *res communis*, *res extra commercium* and the “common heritage of mankind”. Students will also be introduced to the closely related, fundamental principle of non-appropriation of outer space and the consequences thereof for the legal status of outer space.

During the second class, the meaning of the clause requiring space activities to take into account in particular the needs of developing countries will be discussed, as well as the need to have due regard to corresponding interests of all other States. In this regard, the contribution of space science and technology towards the achievement of international development goals will be highlighted. Students will have a chance to reflect on questions relating to the

underlying freedom of exploration and use of outer space without discrimination of any kind, and its legal consequences for international cooperation in outer space activities.

Students will gain insight in the relationship between the Outer Space Treaty and general public international law, which will be illustrated when discussing the application of the United Nations Charter and other rules and principles of international law to outer space. In this context, the concept of “peaceful purposes” will be analysed, including in the context of article IV of the Outer Space Treaty. Finally, students will have a chance to discuss some major

issues of today, including the problems of space debris and the space environment.

Thus, the class will provide students with a basic understanding of the importance and benefits of the Outer Space Treaty in terms of its contribution to a stable and open regime applicable to outer space and outer space activities. Upon completion of the class, students will have the capacity to discuss the fundamental principles of space law guiding the conduct of space activities, providing students with a solid basis for further study throughout the following classes and modules.

References and resources

References

- Outer Space Treaty
<http://www.unoosa.org/oosa/en/SpaceLaw/outerspt.html>
- Declaration of Legal Principles
http://www.unoosa.org/pdf/gares/ARES_18_1962E.pdf
- Benefits Declaration
http://www.unoosa.org/pdf/gares/ARES_51_122E.pdf

Class 3. Other space treaties and General Assembly resolutions



Topics to be covered

The legal regime governing the conduct of space activities

- International treaties
 - ...✦ Rescue Agreement
 - ...✦ Liability Convention
 - ...✦ Registration Convention
 - ...✦ Moon Agreement
- Principles
 - ...✦ Declaration of Legal Principles
 - ...✦ Broadcasting Principles
 - ...✦ Remote Sensing Principles
 - ...✦ Nuclear Power Sources Principles
 - ...✦ Benefits Declaration
- Other relevant topics
 - ...✦ General Assembly resolution 1721 A and B (1961)
 - ...✦ ITU Constitution, Convention and Radio Regulations
 - ...✦ Concept of the “launching State”
 - ...✦ Registration practice

Learning objective

The third class provides students with an overview of the four international space treaties, following on the heels of the Outer Space Treaty and to a certain extent elaborating its provisions. A number of important General Assembly resolutions containing various declarations of principles will also be discussed.

During the class, students will become familiar with the 1968 Rescue Agreement, dealing with the rescue and return of astronauts and space objects; the 1972 Liability Convention, providing a relatively detailed legal regime for dealing with damage caused by space objects in an international context; the 1975 Registration Convention, initiating a dual system of national and international registration of space objects; and the 1979 Moon Agreement, trying to create a more elaborate regime for exploration, use and exploitation of the moon beyond that provided by the Outer Space Treaty. Upon completion of the class, students will have an understanding of the importance and impact of these treaties as part of the international space law regime. Current discussions on advancing adherence, participation and implementation will be highlighted.

Students will also get an overview of the principles, which despite their formally non-binding nature nevertheless provide important contributions to international space law. The class will also address other relevant issues, including registration practices, as laid out in resolutions 1721 A and B of 1961 and resolution 62/101 of 2007; the discussions on radio frequencies and an agreement relating to the

geo-stationary orbit; and the concept of the “launching State”, included in resolution 59/115 of 2004.

Thus, upon completion of the third class, students will have a comprehensive overview of international space law. Students will also know the origins of

international space law, which has emanated essentially from within the United Nations, and against this background, students will be prepared for the final two classes of the first module, where some specific areas of space law are addressed.

References and resources

References

- Rescue Agreement
<http://www.unoosa.org/oosa/en/SpaceLaw/rescue.html>
- Liability Convention
<http://www.unoosa.org/oosa/en/SpaceLaw/liability.html>
- Registration Convention
<http://www.unoosa.org/oosa/en/SORegister/regist.html>
- Moon Agreement
<http://www.unoosa.org/oosa/en/SpaceLaw/moon.html>
- Declaration of Legal Principles
http://www.unoosa.org/pdf/gares/ARES_18_1962E.pdf
- Broadcasting Principles
http://www.unoosa.org/pdf/gares/ARES_37_92E.pdf
- Remote Sensing Principles
http://www.unoosa.org/pdf/gares/ARES_41_65E.pdf
- Nuclear Power Sources Principles
http://www.unoosa.org/pdf/gares/ARES_47_68E.pdf
- Benefits Declaration
http://www.unoosa.org/pdf/gares/ARES_51_122E.pdf
- General Assembly resolution 1721(XVI) A and B, *International cooperation in the peaceful uses of outer space* (Dec. 20, 1961)
http://www.unoosa.org/pdf/gares/ARES_16_1721E.pdf
- General Assembly resolution 1963 (XVIII), *International cooperation in the peaceful uses of outer space* (Dec. 13, 1963)
http://www.unoosa.org/pdf/gares/ARES_18_1963E.pdf

- General Assembly resolution 59/115, *Application of the concept of the “launching State”* (Dec. 10, 2004)
http://www.unoosa.org/pdf/gares/ARES_59_115E.pdf
- General Assembly resolution 62/101, *Recommendations on enhancing the practice of States and international intergovernmental organizations in registering space objects* (Dec. 17, 2007)
http://www.unoosa.org/pdf/gares/ARES_62_101E.pdf
- ITU Constitution and Convention, as amended in 1992, 1994, 1998, 2002, 2006 and 2010
<http://www.itu.int/net/about/basic-texts/index.aspx>
- ITU Radio Regulations, Resolutions and Recommendations, 2008 edition (as amended in 2012)
<http://www.itu.int/pub/R-REG-RR-2008> (2008 edition, not reflecting the 2012 amendments)

Class 4. National regulation, commercialization and privatization



Topics to be covered

The legal regime governing the conduct of space activities

- National regulation of space activities
 - ❖ Authorization and continuing supervision—licensing arrangements
 - ❖ Liability arrangements—reimbursement and insurance
 - ❖ Registration at the national level
- Commercial and private use of outer space
 - ❖ The concepts of “commercialization” and “privatization”

Learning objective

The fourth class provides students with an overview of one area beyond international space law proper, namely that of national regulation of space activities. Although the international space law regime developed essentially from within the United Nations, which still plays a key role in determining its parameters and scope, national regulation of space activities specifically deals with the increasing commercialization and privatization of certain areas of space activities.

During the fourth class, students will have a chance to analyse how national authorization and continuing supervision of different aspects of space activities has taken shape within a number of States, notably through licensing arrangements and/or important rules of national space agencies, and is currently taking shape in a number of others. Students will become familiar with the different reasons for states to undertake such legislative action and gain an understanding of the resulting differences in approach and implementation. The aim is not to discuss the existing or developing regulations in any detail, but rather to demonstrate how the states concerned have taken (or are taking) responsibility to ensure proper implementation on the national level of the international space law regime, and what the consequences of such national regimes are, or could be, at the international level.

Students will have an understanding of the concepts of “commercialization” and “privatization”, and how they operate in the context of outer space activities. Students should also be familiar with how the meaning of the terms “commercial”

and “private” varies among States. Furthermore, in this context, students will be able to discuss different aspects of liability arrangements on reimbursement and insurance and the issue of registration at the national level. Students will also be familiar with the role of national government agencies as potential instruments for both stimulating a State’s participation in space activities and for monitoring and regulating private participation therein

References and resources

References

- Outer Space Treaty
<http://www.unoosa.org/oosa/en/SpaceLaw/outerspt.html>
- Liability Convention
<http://www.unoosa.org/oosa/en/SpaceLaw/liability.html>
- Registration Convention
<http://www.unoosa.org/oosa/en/SORegister/regist.html>
- UNIDROIT Space Protocol
<http://www.unidroit.org/english/conventions/mobile-equipment/spaceassets-protocol-e.pdf>

Thus, upon completion of the fourth class, students will have acquired a deeper understanding of how the increasing commercialization and privatization of several categories of space activities can enjoy guidance from international space law, and at the same time how the unwanted aspects of commercialization and privatization might be curbed or controlled through national regulation.

Online resources

- General Assembly resolution 68/74, *Recommendations on national legislation relevant to the peaceful exploration and use of outer space*, 11 December 2013
http://www.unoosa.org/pdf/gares/A_RES_68_074E.pdf
- National space law database (United Nations Office for Outer Space Affairs)
<http://www.unoosa.org/oosa/en/SpaceLaw/national/state-index.html>
- International Law Association (ILA), Report of the Space Law Committee containing the Sofia Guidelines for a Model Law on National Space Legislation (2012)
<http://www.ila-hq.org/en/committees/index.cfm/cid/29>
- Report of the Working Group on National Space Legislation 2012 (A/AC.105/C.2/101)
<http://www.unoosa.org/oosa/en/COPUOS/Legal/ac105-c2.html>

Class 5. Multilateral and bilateral agreements and intergovernmental organizations



Topics to be covered

The legal regime governing the conduct of space activities

- Multilateral and bilateral agreements
 - ❖ The International Space Station Intergovernmental Agreement
 - ❖ The convention establishing the European Space Agency (ESA)
 - ❖ Selected bilateral agreements relating to space activities
- International intergovernmental organizations and bodies related to space activities
 - ❖ United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) and the United Nations Office for Outer Space Affairs (OOSA)
 - ❖ International Telecommunication Union (ITU)
 - ❖ International satellite organizations
- Settlement of disputes and enforcement of international space law

Learning objective

During the fifth class, students will be exposed to two specific categories of international space law treaties, namely those concerning multilateral or bilateral agreements pertaining to a specific project of international cooperation, and those concerning the establishment and role of intergovernmental organizations. In addition, students will become familiar with the separate issues of the settlement of disputes and enforcement of international space law.

Students will examine some major examples of multilateral and bilateral agreements, notably the International Space Station Intergovernmental Agreement and the convention establishing the European Space Agency (ESA). Furthermore, students will get an overview of a selection of bilateral agreements on space, without going into too much technical detail. The selection of bilateral agreements to be covered will vary depending on the particular region or country where a course using the structure suggested in the curriculum is given.

During the class, students will also gain insight into the establishment and role of international intergovernmental organizations and bodies related to space activities, such as United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) and the United Nations Office for Outer Space Affairs (OOSA), and their influence on the ongoing developments of space law. Students will become familiar with the functions of the International Telecommunication Union (ITU) and its key role in the coordination of radio frequencies, geo-orbital slots and other orbits used for non-telecommunication activities. Students will also

be introduced to the history and role of the international satellite organizations, including the International Telecommunications Satellite Organization (ITSO; oversees INTELSAT), the International Mobile Satellite Organization (IMSO; oversees INMARSAT), Intersputnik, EUTELSAT IGO (oversees EUTELSAT S.A.) and ARABSAT. It is pointed out that Module 3 will deal exclusively and in much more detail with satellite communications, including the functions of the ITU.

Finally, the students will get an overview of settlement of disputes and enforcement of international space law, and the possible roles of the

International Court of Justice, national courts and international arbitration in this context.

Thus, upon completion of the fifth class, students will have gained a basic understanding of several specific projects, intergovernmental organizations, and dispute settlement and enforcement mechanisms, which form a key part of international space law. In many cases, these forms of international cooperation illustrate how the general rules of international space law can become more precise and more concrete when applied to a specific project, organization or issue.

References and resources

References

- International Space Station Intergovernmental Agreement
<ftp://ftp.hq.nasa.gov/pub/pao/reports/1998/IGA.html>
- ESA Convention
<http://esamultimedia.esa.int/multimedia/publications/SP-1317-EN/pageflip.html>
- ITU Constitution and Convention, as amended in 1992, 1994, 1998, 2002, 2006 and 2010
<http://www.itu.int/net/about/basic-texts/index.aspx>
- ITU Radio Regulations, Resolutions and Recommendations, 2008 edition (as amended in 2012)
<http://www.itu.int/pub/R-REG-RR-2008> (2008 edition, not reflecting the 2012 amendments)
- Permanent Court of Arbitration Optional Rules for the Arbitration of Disputes Relating to Outer Space Activities
http://pca-cpa.org/showpage.asp?pag_id=1188

Online resources

- United Nations Committee on the Peaceful Uses of Outer Space
<http://www.unoosa.org/oosa/en/COPUOS/copuos.html>
- United Nations Office of Outer Space Affairs
<http://www.unoosa.org/oosa/index.html>
- ITSO
<http://www.itso.int/>
- INTELSAT
<http://www.intelsat.com/>
- IMSO
<http://www.imso.org>
- INMARSAT
<http://www.inmarsat.com/>
- Intersputnik
<http://www.intersputnik.com/>
- EUTELSAT IGO
<http://www.eutelsatigo.int/>
- EUTELSAT S.A.
<http://www.eutelsat.com>
- ARABSAT
<http://www.arabsat.com/pages/Default.aspx>
- International Court of Justice
<http://www.icj-cij.org/documents/index.php?p1=4&p2=2&p3=0>
- Permanent Court of Arbitration
http://www.pca-cpa.org/showpage.asp?pag_id=1188

Follow-up on Module 1

Test your understanding

1. How do States become bound by international law?
2. Which are the five international treaties and the five sets of principles on outer space, and what are their main objectives?
3. Why do States need national regulatory frameworks for space activities?
4. What is the role of the Committee on the Peaceful Uses of Outer Space in international cooperation relating to outer space?
5. Is outer space an area legally comparable to the high seas, or rather to territorial waters?
6. Does the freedom of space activity result in a freedom to broadcast radio and television programmes at will?
7. What were the main results of the privatization of INTELSAT, INMARSAT and EUTELSAT?

For students interested in further study

Module 1 is “the mother of all modules”, so the main topics to be studied by those wishing to know more would be those dealt with in the other modules. In addition, one might consider adding the following:

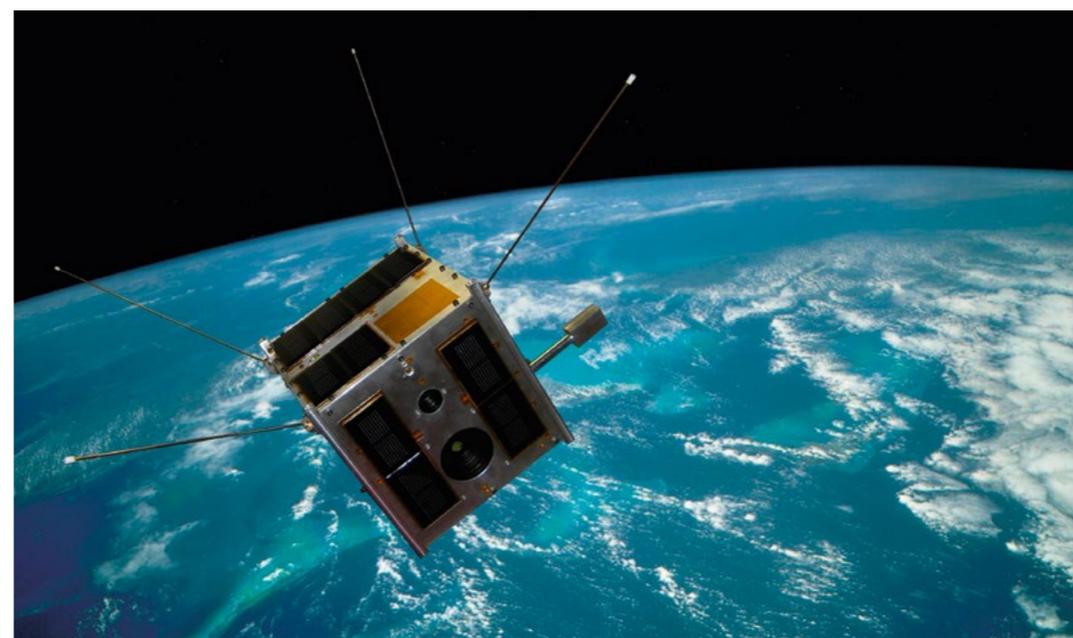
1. Studying national space law and regulation in more detail;
2. Studying the military and security issues involved in space activities and applications and their legal parameters in more detail;
3. Studying the space traffic management, space situational awareness and space debris issues in more detail.

Module 2. International law and other regulations applicable to remote sensing, geographic information systems, satellite meteorology and global climate activities

Introduction

Space technologies play an important role in the area of natural resource management and environmental monitoring. Remotely sensed data in particular provide an unparalleled view of the Earth for studies that require synoptic or periodic observations. These studies include inventory, surveying and monitoring in agriculture, hydrography, geology, mineralogy, land cover, land use and environmental monitoring. Remote sensing is a rapidly evolving technology and it is one of the important spin-offs of space applications and space science. Remote sensing has become a discipline working side-by-side with other disciplines such as photogrammetry, cartography, geodetic reference systems, global navigation satellite systems and geographic information systems (GIS).

Meteorological satellites have been operating almost continuously since the beginning of the space age. In addition to forecasting of weather phenomena, observations from meteorological satellites can be used directly or together with other information in addressing issues such as global warming, ozone depletion and global climate change. Research and development satellites, giving information about the atmosphere and oceans, are also in operation.



Remote sensing and satellite meteorology activities must be carried out in accordance with international law. The Remote Sensing Principles, contained in General Assembly resolution 41/65, stipulate that remote sensing shall be carried out for the benefit and in the interest of all countries, while taking into account the needs and interests of developing countries. The principles emphasize the importance

of the freedom of exploration and use of outer space, to be achieved on the basis of equality. This includes the disclosure of information in cases of natural disasters or scenarios which could be harmful to the Earth's natural environment.

In addition to principles of international law and space law, States are also guided by a number of global, regional, multilateral and bilateral agreements which specifically address remote sensing and its various uses. A number of countries have adopted national laws or policies on remote sensing activities,

covering detailed provisions on how remote sensing is to be carried out. All these instruments together form the framework within which States are continuously developing Earth observation technologies in order to respond to emerging challenges related to natural resources management, land use and protection of the environment.

Module prerequisite: Module 1 on Basic concepts of international law and space law



Module objective

This module provides students with an overview of the basic legal context and the key international rules and principles related to remote sensing and GIS, satellite meteorology and global climate activities. Students are familiarized with international and national regulatory regimes relating to Earth observation, as well as with global, regional, multilateral and bilateral agreements on remote sensing and its various uses. Finally, the module introduces students to the sources of data, various data providers and conditions of access to databases and archives.



Learning outcomes

1. **Awareness of international and national laws and regulatory regimes relating to remote sensing and GIS, satellite meteorology and global climate activities.**
2. **Awareness of global, regional, multilateral and bilateral agreements relating to remote sensing and GIS, satellite meteorology and global climate activities.**
3. **Awareness of legal issues regarding sources of data.**



Module design

The module consists of five classes of two hours each. The classes should consist of approximately 60 minutes of instruction, followed by at least 30 minutes for questions and discussion. Active student involvement will be a primary goal.

The class-specific programme can focus on those topics, issues and areas that are most relevant to the audience. At the end of each class description, students are given a list of reading materials to support their studies. For easy access to resources and references, most materials in the reading list are available online.

Table 3. Breakdown of module 2 by topic and activity

Class	Topic	Activity (hours)		
		L	T+P	Total
1	International law relating to remote sensing	2	0	2
2	National legislation on remote sensing	2	0	2
3	Regional and global agreements on remote sensing	2	0	2
4	Bilateral and multilateral agreements on remote sensing	2	0	2
5	Sources of remote sensing data	2	0	2
Total		10	0	10

Note: L = lectures; T+P = tutorials and practical exercises.

Class 1. International law relating to remote sensing



Topics to be covered

- International regulatory regimes relating to Earth observation
 - Outer Space Treaty
 - Remote Sensing Principles
 - General Assembly resolution 61/110 (2006)
 - WMO Resolution 40
 - Benefits Declaration

Learning objective

During the first class, students will become familiar with international law relating to remote sensing, GIS, satellite meteorology and global climate activities. Students have already learned in Module 1 that according to the Outer Space Treaty, all States have the non-exclusive right to use and explore space. In this context, students will learn that as remote sensing is a use of space, all nations therefore also have the right to conduct space-based remote sensing.

During the class, students will become familiar with the United Nations Remote Sensing Principles. The principles, which encourage and set a standard for international cooperation among States, lay out that a sensed State shall have non-discriminatory access to primary, processed data and analysed information at reasonable cost. The principles also stipulate that the needs of developing countries shall be taken into particular consideration when carrying out remote sensing activities.

Students will learn that the Remote Sensing Principles specifically promote the protection of the Earth's environment and of humankind from natural disasters, and students will have a chance to discuss accessing and using remote sensing technologies during all phases of a disaster (General Assembly resolution 61/110). Access to and use of meteorological remote sensing and worldwide cooperation in the establishment of observing networks, promotion of the exchange of meteorological and related information in the interest of all nations will also be discussed (WMO Resolution 40).

Upon completion of the class, students will be able to discuss what it means that cooperation should, among other things, aim to promote the development of space science and technology and its applications; foster the development

of relevant and appropriate space capabilities in interested States; and facilitate the exchange of expertise and technology among States on a mutually acceptable basis (Benefits Declaration).

References and resources

References

- Outer Space Treaty
<http://www.unoosa.org/oosa/en/SpaceLaw/outerspt.html>
- Remote Sensing Principles
http://www.unoosa.org/pdf/gares/ARES_41_65E.pdf
- Benefits Declaration
http://www.unoosa.org/pdf/gares/ARES_51_122E.pdf
- WMO Resolution 40 (Cg-XII)
http://www.wmo.int/pages/prog/www/ois/Operational_Information/Publications/Congress/Cg_XII/827_en.pdf
- General Assembly resolution 61/110, *United Nations Platform for Space-based Information for Disaster Management and Emergency Response* (Dec. 14, 2006)
http://www.oosa.unvienna.org/pdf/gares/ARES_61_110E.pdf

Class 2. National legislation on remote sensing



Topics to be covered

- National regulatory regimes relating to Earth observation
 - ❖ Canada
 - Licensing
 - Data access
 - ❖ France
 - Space operations
 - ❖ Germany
 - Satellite operation
 - General data distribution
 - Specific data transactions
 - ❖ India
 - Remote Sensing Data Policy
 - ❖ Iran
 - Statute of the Iranian Space Agency
 - ❖ Japan
 - Space operations
 - ❖ United Kingdom
 - 1986 Outer Space Act
 - ❖ United States
 - Satellite operating licence
 - Data distribution licence

Learning objective

During this class, students will be introduced to national legal frameworks on remote sensing that have evolved around the world, including those of Canada, France, Germany, India, Iran (Islamic Republic of), Japan, the United Kingdom and the United States. Students will see how some elements of the Remote Sensing Principles have been incorporated into those national regulatory frameworks, and how each State has adapted the principles and crafted legislation to address its own specific needs. Students will become familiar with topics like data access, satellite operating licences and data distribution licences. Upon completion of the class, students will have an overview of national legislation on remote sensing activities.

References and resources

References

- Canada Remote Sensing Systems Act
<http://laws-lois.justice.gc.ca/eng/acts/R-5.4/FullText.html>
<http://laws-lois.justice.gc.ca/eng/regulations/SOR-2007-66/page-1.html>
- French Law no. 2008-518 of 3 June 2008 (*Loi n° 2008-518 du 3 juin 2008 relative aux opérations spatiales*)
<http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=LEGITEXT000018939303> (original)
<http://download.esa.int/docs/ECSL/France.pdf> (unofficial English translation)
- German Act on Satellite Data Security
<http://www.gesetze-im-internet.de/satdsig/index.html> (original)
<http://www.spacelaw.olemiss.edu/jsl/pdfs/back-issues/jsl-34-1.pdf>
(article pp. 97-114, unofficial English translation pp. 115-140)
- Indian Remote Sensing Data Policy
<http://www.isro.org/news/pdf/RSDP-2011.pdf>
- Statute of the Iranian Space Agency
<http://www.spacelaw.olemiss.edu/jsl/pdfs/back-issues/jsl-34-2.pdf>
(unofficial English translation pp. 487-495)
- Japanese Law: Geospatial Information Utilization Promotion Bill of May 30, 2007, 33rd Journal of Space Law, pp. 457-469 (2007)
http://www.spacelaw.olemiss.edu/JSL/Back_issues/JSL%2033-2.pdf
- Japanese Fundamental Act of Outer Space
<http://www.spacelaw.olemiss.edu/jsl/pdfs/back-issues/jsl-34-2.pdf>
(unofficial English translation pp. 471-485)
- United Kingdom 1986 Outer Space Act
<http://www.legislation.gov.uk/ukpga/1986/38>
- United States Land Remote Sensing Policy Act of 1992
http://www.law.cornell.edu/uscode/html/uscode15/usc_sup_01_15_10_82.html
- United States Commercial Remote Sensing Regulations
<http://www.nesdis.noaa.gov/CRSRA/files/15%20CFR%20Part%20960%20Regs%202006.pdf>

Class 3. Regional and global agreements on remote sensing



Topics to be covered

- Regional and global agreements
 - ❖ The Vienna Convention on the Protection of the Ozone Layer (1985)
 - ❖ Montreal Protocol (1987)
 - ❖ International Charter on Space and Major Disasters
 - ❖ Committee on Earth Observations Satellites (CEOS)
 - ❖ Group on Earth Observations (GEO)
 - ❖ International Geosphere-Biosphere Programme (IGBP)
 - ❖ Copernicus (previously Global Monitoring for Environment and Security (GMES))

Learning objective

During the class, students will get an overview of remote sensing issues at the regional and global levels. Students will be familiarized with topics such as long-term regional monitoring and monitoring of the Earth for carbon emissions, ozone depletion and disasters. Students will study a variety of agreements dealing with these topics, including the 1985 Vienna Convention on the Protection of the Ozone Layer, the 1989 Montreal Protocol and the International Charter on Space and Major Disasters.

Upon completion of the class, students will be familiar with the functions of a number of institutions and organizations that have a role in implementing international cooperation and monitoring through Earth observation, including the Committee on Earth Observations Satellites (CEOS), the Group on Earth Observations (GEO), the International Geosphere-Biosphere Programme (IGBP) and Copernicus. Students will learn about these organizations, why and how they were formed and what the nature of their work is. Some monitoring constellations will also be discussed, including the Disaster Monitoring Constellation (DMC).

References and resources

References

- The 1985 Vienna Convention on the Protection of the Ozone Layer
http://ozone.unep.org/Publications/VC_Handbook/index.shtml
- The 1989 Montreal Protocol
http://ozone.unep.org/Publications/MP_Handbook/Section_1_The_Montreal_Protocol/index.shtml
- International Charter on Space and Major Disasters
<http://www.disasterscharter.org/web/charter/charter>

Online resources

- Committee on Earth Observation Satellites (CEOS)
<http://www.ceos.org/>
- Group on Earth Observations (GEO)
<http://www.earthobservations.org/index.shtml>
- International Geosphere-Biosphere Programme (IGBP)
<http://www.igbp.net/>
- Copernicus
<http://www.copernicus.eu/>
- Disaster Monitoring Constellation
<http://www.dmcii.com/>

Class 4. Bilateral and multilateral agreements on remote sensing



Topics to be covered

- Bilateral and multilateral agreements
 - ❖ CBERS: Brazil and China
 - ❖ COSMO-SkyMed: France and Italy
 - ❖ PLEIADES: France and Italy
 - ❖ RADARSAT: Canada and the United States
 - ❖ Aquarius/SAC-D: Argentina, Brazil, Canada, France, Italy and the United States

Learning objective

During the class, students will be introduced to remote sensing agreements between States on a bilateral or multilateral basis. These agreements are negotiated and implemented outside of regional and global intergovernmental organizations and they deal with different kinds of satellites with different capabilities, including public-private partnerships, government-to-government arrangements, and dual use systems.

Upon completion of the class, students will be familiar with the China-Brazil Earth Resources Satellite (CBERS) agreement; the Constellation of Small Satellites for Mediterranean Basin Observation (COSMO-SkyMed) and Pleiades agreements between France and Italy; the 2000 Agreement on Commercial Remote Sensing Satellite Systems and RADARSAT agreements between Canada and the United States; and the Aquarius/SAC-D Mission of Argentina and the United States, with participation from Brazil, Canada, France and Italy.

References and resources

Online resources

- China–Brazil Earth Resources Satellite (CBERS)
<http://www.cbears.inpe.br/ingles/>
- COSMO-SkyMed: Mission Definition and Main Application and Products
<http://www.cosmo-skymed.it/en/index.htm>
- PLEIADES
<http://smc.cnes.fr/PLEIADES/>
- 2000 United States-Canada Agreement on Commercial Remote Sensing Satellite Systems
<http://www.treaty-accord.gc.ca/text-texte.aspx?id=103522>
- Aquarius/SAC-D
<http://aquarius.nasa.gov/> and <http://www.invap.com.ar/es/area-aeroespacial-y-gobierno/proyectos/satelite-sac-daquarius.html>

Class 5. Sources of remote sensing data



Topics to be covered

- Sources of data
 - ❖ Civil government systems
 - ❖ Private commercial systems
 - DigitalGlobe
 - Imagesat International
 - ❖ Public-private partnership commercial systems
 - Radarsat
 - SPOT
 - TerraSAR-X
 - ❖ Databases and regulations
 - ❖ Archives
 - European Infrastructure for Spatial Information in Europe (INSPIRE)
 - National Satellite Land Remote Sensing Data Archive

Learning objective

During the class, students will get an introduction to the sources of satellite data, including the satellites, databases and archives, and access conditions for some of those services. Students will become familiar with the satellite categories, including civil government systems (for example, the Landsat satellites); private commercial systems (for example, DigitalGlobe and Imagesat International); and public-private partnership commercial systems (for example, Radarsat, SPOT and Terra-SAR-X). Students will also be introduced to databases and examples of the laws that govern them, including the EU Database Protection Directive. Upon completion of the class, students will also be familiar with various archives and initiatives that either store and/or disseminate data for the long term. In this regard, the European Infrastructure for Spatial Information in Europe (INSPIRE) initiative and the United States National Satellite Land Remote Sensing Data Archive will be discussed.

References and resources

Online resources

- Landsat Program
<http://landsat.gsfc.nasa.gov/>
- DigitalGlobe
<http://www.digitalglobe.com/>
- Imagesat International
<http://www.imagesatintl.com/>
- RADARSAT
<http://www.asc-csa.gc.ca/eng/satellites/radarsat1/>
<http://www.asc-csa.gc.ca/eng/satellites/radarsat2/>
<http://www.asc-csa.gc.ca/eng/satellites/radarsat/>
- SPOT
<http://www.astrium-geo.com/en/143-spot-satellite-imagery>
- Terra-SAR-X
<http://www.astrium-geo.com/terrasar-x/>
- EU Data Protection Directive
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31995L0046:EN:HTML>
- EU INSPIRE Geoportal
<http://inspire.jrc.ec.europa.eu/>
- United States National Satellite Land Remote Sensing Data Archive
<http://eros.usgs.gov/archive/nslrda/>
- Indian Remote Sensing Satellite data
http://www.antrix.gov.in/earth_observation.html

Follow-up on Module 2

Test your understanding

Class 1. International legislation

1. What are the major sources of international law on remote sensing?
2. What do these sources provide?
3. What agreements address activities related to disasters?

Class 2. National legislation

1. Which States have national legislation on remote sensing? Name one feature these laws have in common with international law.
2. What is an operating license?
3. What is a data access license?

Class 3. Regional and global agreements

1. What is the most common subject matter of regional and global agreements?
2. Name some of the organizations established under these agreements.
3. What is the oldest regional agreement in this category?

Class 4. Bilateral and multilateral agreements

1. What is the difference between a “bilateral” and a “multilateral” agreement?
2. What kinds of entities enter into these agreements?
3. What does “dual use” mean?

Class 5. Sources of data

1. Name three categories of data providers.
2. Name two satellite company data providers.
3. Name two government data providers.

For students interested in further study

For students interested in further study the following additional important aspects are recommended:

1. Intellectual property (IP) law
<http://www.wipo.int/about-ip/en/>
<http://www.wipo.int/library/en/>
2. Creative Commons: making it easier for people to share and build upon the work of others, consistent with the rules of copyright.
<http://creativecommons.org/about>
3. The use of satellite data in international litigation (see, for example, the Report of the International Law Association Space Law Committee, 2012)
<http://www.ila-hq.org/en/committees/index.cfm/cid/29>

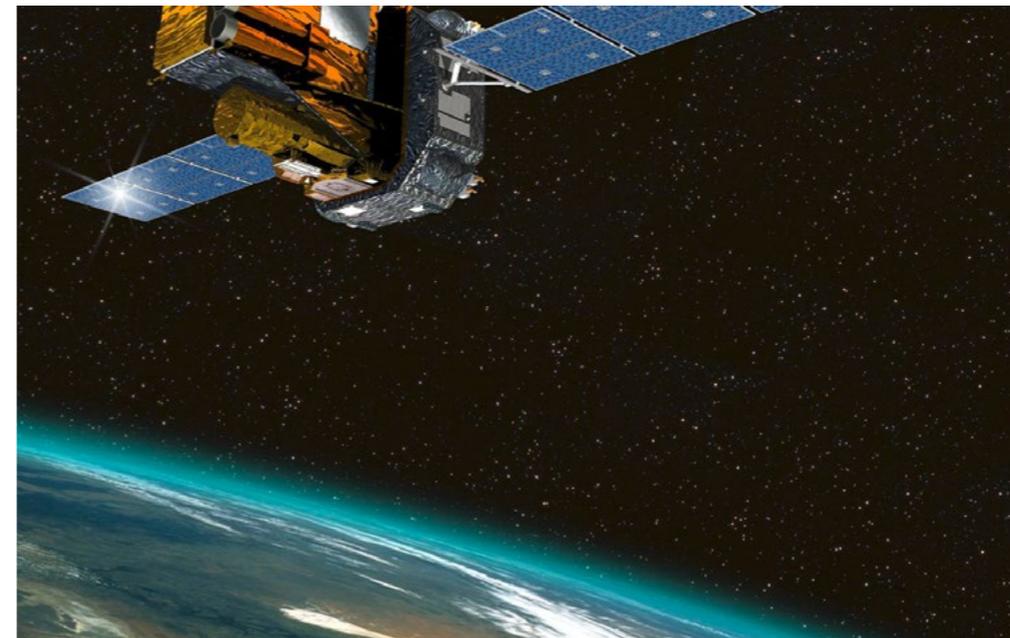
Module 3. Satellite communications and applicable international law and other regulations

Introduction

As laid out in the Outer Space Treaty of 1967, outer space is free for exploration and use by all States without discrimination, on the basis of equality and in accordance with international law. However, outer space is not subject to national appropriation by claim of sovereignty, or by use, occupation or any other means, and therefore it cannot come under the ownership of any State or private entity. The same applies for orbital positions used by satellites: nobody owns orbital positions, since they are a common resource which can be used as long as international regulations and procedures are fully complied with.

The International Telecommunication Union (ITU) is the specialized agency of the United Nations responsible for the international regulation and management of the radio-frequency spectrum and orbital resources, which are indispensable not only for satellite communications but also for all space missions. ITU member States have agreed on a legal regime covering these issues, and the applicable rules can be found in the ITU Constitution and Convention and in the ITU Radio Regulations.

Article 44 of the ITU Constitution establishes that member States shall “bear in mind that radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources and that they must be used rationally, efficiently and economically, in conformity with the provisions of the Radio



Regulations, so that countries or groups of countries may have equitable access to those orbits and frequencies, taking into account the special needs of the developing countries and the geographical situation of particular countries.”

Satellite communications are consequently also regulated on the national level, as States ultimately bear responsibility for space activities carried out by any of their public or private entities. Such national regulation, control and

supervision includes licensing and regulation procedures relating to the operation of satellite services and the application of internationally agreed technical standards.

Satellite systems for communications have opened up channels for information exchange, making distances between locations on opposite sides of the Earth seem shorter than ever before. The regulation of the flow of information has been a highly political issue both nationally and internationally since the dawn

of the space age. The transmission, interception and distribution of satellite signals continues to spur discussions among States, and regulatory frameworks are constantly adapted to changing circumstances in an effort to find a balance between efficiency and equity on the one hand, and between freedom and restraint on the other.

Module prerequisite: Module 1 on Basic concepts of international law and space law



Module objective

This module provides students with an overview of the basic legal context and the key international legal concepts, terminology, rules and principles related to satellite communications activities. The thrust of this module is essentially to be complementary to the education curriculum on satellite communications, which is currently taught by the Regional Centres and is also available on the OOSA website.

Upon completion of the module, students will be familiar with issues relating to international coordination and registration with the ITU of radio frequencies and orbital positions. During the classes in this module, students are introduced to processes of national licensing and regulation of the operation of satellite services, and to the adoption and application of technical standards. Students will also become aware of questions relating to harmful interference and resolution of disputes. In addition, students are familiarized with various regulations of the World Trade Organization (WTO) and procedures of the Global Mobile Personal Communication Services (GMPCS). Upon completion of the module, students will be able to discuss issues relating to the regulation of direct satellite broadcasting in the light of various instruments of international and national law.



Learning outcomes

1. Awareness of international and national regulatory regimes relating to satellite communications and satellite broadcasting activities.
2. Awareness of national licensing processes and international coordination of the use of radio frequencies and orbital positions; the necessity of technical standards; and the resolution of interference disputes.
3. Awareness of legal issues relating to the operation of and international trade in satellite communication services.



Module design

The module consists of five classes of two hours each, with the exception of class 2 (see below). The classes should consist of approximately 60 minutes of instruction, followed by at least 30 minutes for questions and discussions. Active student involvement will be a primary goal.

The class-specific programme can focus on those topics, issues and areas that are most relevant to the audience. At the end of each class description, students are given a list of reading materials to support their studies. For easy access to resources and references, most materials in the reading list are available online.

The first two classes make up a unit which gives students an overview of international law related to satellite communications. The descriptions of the two classes are therefore combined in one section. Class 2 includes 60 minutes for conducting a practical exercise. Bearing that in mind, it is suggested that the total time allotted for class 2 be three hours.

Table 4. Breakdown of module 3 by topic and activity

Class	Topic	Activity (hours)		
		L	T+P	Total
1	Overview of international law on satellite communications (first part)	2	0	2
2	Overview of international law on satellite communications (second part)	2	1	3
3	Technical standards and national licensing	2	0	2
4	International trade in satellite communication services and global mobile personal communication services	2	0	2
5	Satellite broadcasting	2	0	2
Total		10	1	11

Note: L = lectures; T+P = tutorials and practical exercises.

Classes 1 and 2. Overview of international law on satellite communications



Topics to be covered

- Access to and use of radio frequencies and orbital positions
 - ... ITU Constitution, Convention and Radio Regulations
 - ... Selection of appropriate radio frequencies and orbital positions
 - ... How to acquire radio frequencies and appropriate orbital positions
 - “First-Come, First Served” and a priori planning procedures
 - Coordination and registration with ITU
 - ... Harmful interference and resolution of interference problems
 - ... National laws and regulations (including those that implement international law)

Learning objective

The first two classes will introduce students to the principles and rules of international law related to satellite communications which are primarily contained in the Constitution and Convention of the International Telecommunication Union (ITU) as well as in its Radio Regulations.

During the first two classes, students will become familiar with questions relating to access to and interference-free use of appropriate radio frequencies and orbital positions, which are indispensable for satellite communications. Students will learn about the extensive regulation of satellite communications, both internationally and nationally. Topics such as national selection, international procedures to be followed for coordination and registration of radio frequencies with ITU, and the avoidance and resolution of harmful interference problems will be addressed.

During the second class, a practical case-study exercise will be carried out explaining the regulatory steps that a company or a satellite operator would need to follow in order to acquire access to and interference-free use of the required radio frequencies and orbital positions.

Upon completion of the first two classes, students will be able to answer the following questions: Who makes the international law on satellite communications and what are the main features of these rules? What regulatory steps need to be followed by an operator of satellite communication services?

References and resources

References

- ITU Constitution and Convention, as amended in 1992, 1994, 1998, 2002, 2006 and 2010
<http://www.itu.int/net/about/basic-texts/index.aspx>
- ITU Radio Regulations, Resolutions and Recommendations, 2008 edition (as amended in 2012)
<http://www.itu.int/pub/R-REG-RR-2008> (2008 edition, not reflecting the 2012 amendments)

Online resources

- National space law database (United Nations Office for Outer Space Affairs)
<http://www.oosa.unvienna.org/oosa/en/SpaceLaw/national/state-index.html>
- Schematic overview of national regulatory frameworks for space activities (United Nations Office for Outer Space Affairs)
<http://www.oosa.unvienna.org/oosa/en/SpaceLaw/national/schematic-overview.html>

Class 3. Technical standards and national licensing



Topics to be covered

- Adoption and application of technical standards
 - ❖ International (ITU) and national regulations
- National licensing and regulation of the operation of satellite services
 - ❖ Network planning

Learning objective

During this class, students will learn that in order to ensure effective communications by satellite, all networks must operate by using common technical standards, procedures and recommendations. Upon completion of the class, students will be familiar with how such standards are adopted, primarily through ITU, and how they are implemented (applied) through national regulatory systems for communications so that all satellite users are in a position to communicate effectively and efficiently.

Upon completion of the class, students will know that all states impose requirements on operators of satellite communications to acquire national licenses from appropriate authorities. Students will be able to name and discuss some general international obligations and requirements for acquiring such licenses (as specified in the ITU Constitution, Convention and Radio Regulations) and what national rules and procedures need to be respected by the operators of satellite communications systems.

References and resources

References

- ITU Constitution and Convention, as amended in 1992, 1994, 1998, 2002, 2006 and 2010
<http://www.itu.int/net/about/basic-texts/index.aspx>
- ITU Radio Regulations, Resolutions and Recommendations, 2008 edition (as amended in 2012)
<http://www.itu.int/pub/R-REG-RR-2008> (2008 edition, not reflecting the 2012 amendments)
- ITU Recommendations/standards
<http://www.itu.int/en/ITU-T/publications/Pages/recs.aspx>

Online resources

- National space law database (United Nations Office for Outer Space Affairs)
<http://www.oosa.unvienna.org/oosa/en/SpaceLaw/national/state-index.html>
- Schematic overview of national regulatory frameworks for space activities (United Nations Office for Outer Space Affairs)
<http://www.oosa.unvienna.org/oosa/en/SpaceLaw/national/schematic-overview.html>

Class 4. International trade in satellite communication services and global mobile personal communication services



Topics to be covered

- World Trade Organization regulations
 - ❖ General principles of trade in services (especially communications)
 - ❖ Agreement on basic telecommunication services (1997)
 - Competition
 - Universal service
- Global mobile personal communication services (GMPCS) procedures
 - ❖ Memorandum of Understanding—GMPCS (1998)

Learning objective

During this class, students will become familiar with the World Trade Organization (WTO), the international organization that deals with the global rules of trade in commodities and services among States. Students will get an overview of the developments of the communications arena since the mid-nineties, when the traditional government communication monopolies started being replaced by privately owned companies operating in a competitive environment.

Students will learn that the WTO member countries have agreed to liberalize their communication sector and to open up their markets in this sector at various levels. WTO member States have also agreed that the operation of national communications must be such that foreign capital and operators are allowed in to compete domestically. Students will learn that the WTO's General Agreement on Trade in Services (GATS) puts trade in communications services, both basic and value-added, within the ambit of the new multilateral trading system. Upon completion of the class, students will be able to identify the most important regulatory principles which must be followed by WTO member States in the design of their national communications regulatory frameworks, dealing with competition safeguards, interconnection guarantees, universal service and independence of the regulator. These regulatory principles are contained in the 1997 Agreement on Basic Telecommunications, which imposes worldwide commitment to opening markets, promoting competition and preventing anti-competitive conduct in all communications services (wire-based, radio-based or satellite-based), and in the so-called Reference Paper, both of which are included in the GATS.

During this class, students will also become familiar with global mobile personal communications services (GMPCS), which is a personal communication system providing transnational, regional or global coverage from a constellation of satellites accessible with small and easily transportable terminals. A Memorandum of Understanding (MoU) on the topic, drafted through ITU, contains voluntary

principles that have been developed to help national policymakers, regulatory authorities, GMPCS operators and service providers manage the introduction and operation of GMPCS. Upon completion of the class, students will be able to discuss these principles, especially those that deal with technical certification, customs-free circulation of GMPCS terminals across borders and roaming.

References and resources

References

- General principles of trade in services (especially communications)
http://www.wto.org/english/tratop_e/serv_e/serv_e.htm
- Agreement on basic telecommunication services (1997)
http://www.wto.org/english/tratop_e/serv_e/telecom_e/telecom_e.htm
http://www.wto.org/english/tratop_e/serv_e/12-tel_e.htm
- Reference paper on telecommunications services (1996)
http://www.wto.org/english/tratop_e/serv_e/telecom_e/tel23_e.htm
- ITU Memorandum of Understanding—GMPCS (1998)
<http://www.itu.int/en/gmpcs/Pages/default.aspx> (guidance on access for external users can be found at the bottom of the page)

Class 5. Satellite broadcasting



Topics to be covered

- Regulation of direct satellite broadcasting contents
 - ❖ Broadcasting Principles (1982)
 - ❖ UNESCO declaration on satellite broadcasting (1972)
 - ❖ ITU a priori plans for broadcasting satellite services
 - ❖ ITU Radio Regulations, article 23, section II, on broadcasting satellite service
 - ❖ Regional and national regulation of broadcast contents
 - ❖ International Convention Concerning the Use of Broadcasting in the Cause of Peace, signed at Geneva (1936)
 - ❖ General Assembly resolution 110 (II) (1947)
 - ❖ Universal Declaration of Human Rights (1948) and human rights conventions
 - ❖ Unauthorized distribution of satellite signals
 - Brussels Convention (1974)

Learning objective

During this class, students will discuss the regulation of the flow of information, which has always been a highly political issue both nationally and internationally. From the dawn of the space age, direct broadcasting by satellite (DBS) has been controversial, with some States favouring the requirement of agreements between the transmitting and receiving States prior to starting up of a DBS service and other States preferring freedom of the flow of information without any restriction.

First, during this class, students will be introduced to several legal texts with a view to gaining an understanding of the state of law at both the international and national levels. These texts will include, but are not limited to, the principle of freedom of broadcasting based on international customary law, as well as the 1948 Universal Declaration of Human Rights (in particular article 19) and the International Covenant on Civil and Political Rights (in particular article 19), which lay out the obligations of States to guarantee the freedom of expression and the right to receive and impart information; the 1936 Convention on the Use of Broadcasting in the Cause of Peace; the radio frequency coordination requirements under the ITU regulations, ITU a priori allotment plans and article 23 of the ITU Radio Regulations, dealing with broadcasting services; the 1972 UNESCO Declaration on the Use of Satellite Broadcasting for the Free Flow of Information, the Spread of Education and Greater Cultural Exchange; the Broadcasting Principles contained in General Assembly resolution 37/92 of 1982; and General Assembly resolution 110 (II) of 1947, condemning propaganda designed or likely to provoke or encourage any threat to peace, breach of the peace or act of aggression.

Second, the class will address the issue of interception and distribution of satellite signals. Upon completion of the class, students will be familiar with the problems concerning unauthorized interception and distribution of radio signals. As radio signals transmitted by a satellite are generally available over wide geographical areas, their unauthorized interception and distribution may

occur in many countries which are within the footprints of that satellite. Students will discuss these concerns and how the problem of piracy of satellite programmes is regulated to some extent under the 1974 Brussels Convention Relating to the Distribution of Programme-Carrying Signals Transmitted by Satellite.

References and resources

References

- Outer Space Treaty
<http://www.unoosa.org/oosa/en/SpaceLaw/outerspt.html>
- Broadcasting Principles
http://www.unoosa.org/oosa/en/SpaceLaw/gares/html/gares_37_0092.html
- ITU Constitution and Convention, as amended in 1992, 1994, 1998, 2002, 2006 and 2010
<http://www.itu.int/net/about/basic-texts/index.aspx>
- ITU Radio Regulations, Resolutions and Recommendations, 2008 edition (as amended in 2012)
<http://www.itu.int/pub/R-REG-RR-2008> (2008 edition, not reflecting the 2012 amendments)
- Regulation of Global Broadband Satellite Communications, April 2012
http://www.itu.int/ITU-D/treg/broadband/ITU-BB-Reports_RegulationBroadbandSatellite.pdf
- The Universal Declaration of Human Rights
<http://www.un.org/en/documents/udhr/>
- International Covenant on Civil and Political Rights, 1966
<http://www.ohchr.org/en/professionalinterest/pages/ccpr.aspx>
- International Convention Concerning the Use of Broadcasting in the Cause of Peace, 1936
<http://www.jstor.org/stable/2213758?seq=1>

- Convention Relating to the Distribution of Programme-Carrying Signals Transmitted by Satellite, Brussels, 1974
<http://www.wipo.int/treaties/en/ip/brussels>
- General Assembly resolution 61/110, *United Nations Platform for Space-based Information for Disaster Management and Emergency Response* (Dec. 14, 2006)
http://www.oosa.unvienna.org/pdf/gares/ARES_61_110E.pdf
- UNESCO, Declaration of Guiding Principles on the Use of Satellite Broadcasting for the Free Flow of Information, the Spread of Education and Greater Cultural Exchange, 1972
http://portal.unesco.org/en/ev.php-URL_ID=17518&URL_DO=DO_TOPIC&URL_SECTION=201.html

Follow-up on Module 3

Test your understanding

1. What international regulatory procedures would your country have to follow in order to procure interference-free use of appropriate radio frequencies and related geostationary orbital positions for a private company, incorporated in your country, looking to start providing satellite communication services?
2. Describe the relevant provisions (and their limitations) of international treaties providing protection against “piracy” of programme-carrying satellite signals.
3. “There exists no right of freedom of international broadcasting by satellite.” Discuss the validity of this statement by citing relevant international legal principles and rules.

For students interested in further study

For students interested in further study, the following additional important aspects are recommended:

1. Legal aspects of purchasing or leasing communication satellites and/or transponders;
2. Negotiation for and conclusion of contracts for international satellite communications services;
3. Compliance with and protection of intellectual property rights in programmes broadcasted via satellite.

Module 4. Global navigation satellite systems and applicable international law and other regulations

Introduction

Global navigation satellite systems (GNSS) are systems of satellites which provide continuously optimized location and time information, transmitting a variety of signals on multiple frequencies available at all locations on Earth.

GNSS can have both civilian and military uses, and air and maritime navigation increasingly rely on GNSS. Currently, GNSS services are provided by the Global Positioning System (GPS) of the United States, the Global Navigation Satellite System (GLONASS) of the Russian Federation, Galileo of the European Union and Compass/BeiDou of China. Additional regional capacities to provide enhanced regional coverage have been developed by India and Japan.

Various aspects of international law, and space law in particular, are relevant to the operation of GNSS, including issues related to the access to and use of radio frequencies and orbital positions, the registration of satellites, the right of access to GNSS services, interference with GNSS signals, financing of GNSS and liability for negligent GNSS services. States continue to meet under the auspices of the International Committee on Global Navigation Satellite Systems (ICG) to discuss and resolve questions such as interoperability and compatibility of GNSS



services, non-interference with other GNSS systems and increasing GNSS use to support sustainable development, particularly in the developing countries.

Module prerequisite: Module 1 on Basic concepts of international law and space law



Module objective

This module provides students with an overview of the basic legal context, key legal concepts and terminology of satellite navigation and time positioning. Students are introduced to GNSS laws and regulations, as well as to the international forums for discussion and cooperative decision-making among governments for resolving problems related to GNSS. Students will become familiar with GNSS services used to provide greater positioning accuracy and will learn about the characteristics of individual GNSS providers and national legal regimes affecting GNSS. Specific aspects of space law that are of key relevance to GNSS will be highlighted. Finally, students are familiarized with the various uses of GNSS, including the dual use of GNSS technology for civilian and military purposes. An overview of current and/or continuing problems will conclude the module.



Learning outcomes

1. Awareness of regulatory frameworks for GNSS.
2. Awareness of legal terminology related to GNSS and the applicable legal framework for GNSS.
3. Awareness of issues related to international cooperation and problem resolution approaches for GNSS.



Module Design

The module consists of five classes of two hours each. The classes should consist of approximately 60 minutes of instruction, followed by at least 30 minutes for questions and discussion. Active student involvement will be a primary goal.

The class-specific programme can focus on those topics, issues and areas that are most relevant to the audience. At the end of each class description, students are given a list of reading materials to support their studies. For easy access to resources and references, most materials in the reading list are available online.

Table 5. Breakdown of module 4 by topic and activity

Class	Topic	Activity (hours)		
		L	T+P	Total
1	International institutional context for GNSS operations	2	0	2
2	GNSS providers and GNSS augmentation	2	0	2
3	GNSS users	2	0	2
4	Legal framework for GNSS services	2	0	2
5	GNSS services, uses and current problems	2	0	2
Total		10	0	10

Note: L = lectures; T+P = tutorials and practical exercises.

Class 1. The international institutional context for global navigation satellite systems operations



Topics to be covered

- International institutional context for global navigation satellite systems (GNSS) operations
 - Committee on the Peaceful Uses of Outer Space (COPUOS)
 - The International Committee on Global Navigation Satellite Systems (ICG)
 - International Civil Aviation Organization (ICAO)
 - International Maritime Organization (IMO)
 - International Telecommunication Union (ITU)

Learning objective

During the class, students will be introduced to the international regulatory institutions and organizations related to global navigation satellite systems (GNSS). Students will become familiar with the background for the establishment of the International Committee on Global Navigation Satellite Systems (ICG), namely, the need for an international multimodal forum for governments to discuss and cooperatively resolve problems such as interoperability of GNSS services and non-interference with each other's GNSS systems. The functions of a number of actors relevant to GNSS are described, including the ICG, the United Nations and its Committee for the Peaceful Uses of Outer Space (COPUOS) and the United Nations Office for Outer Space Affairs (OOSA).

During the first class, students will learn about the increasing reliance of international air navigation on GNSS. Students will have a chance to analyse and discuss the ICAO member States' legal right to deviate from international flight standards, while taking into account how such deviations can lead to severe air safety problems. Students will become familiar with the Convention on International Civil Aviation (Chicago Convention) and ICAO's legal mandate under article 44 (*h*) to "promote safety of flight in international air navigation",

ICAO's Global Air Navigation Plan, as well as the ICAO Standards and Recommended Practices (SARPS) for aircraft navigation by GNSS.

Upon completion of the first class, students will also be familiar with the ICAO Charter on Rights and Obligations of States Relating to GNSS Services and IMO's legal requirements for ships to have and use GNSS equipment in maritime navigation. Finally, students will build on their knowledge from Module 3 on

satellite communications and further discuss the need for adequate radio frequencies for communication with GNSS satellites and the role of the ITU not only in allocating necessary radio frequencies, but also in preventing radio interference among the competing GNSS operators operating in proximate orbits and using proximate radio frequencies. Lastly, students will become familiar with the dangers of intentional and accidental signal interferences and the importance of efforts to track and eliminate such interferences.

References and resources

References

- Outer Space Treaty
<http://www.unoosa.org/oosa/en/SpaceLaw/outerspt.html>
- Convention on International Civil Aviation (1944)
<http://www.icao.int/publications/pages/doc7300.aspx>
- Convention on International Civil Aviation, annex 10
http://www.icao.int/Documents/annexes_booklet.pdf
- ICAO Assembly Resolution A32-19, *Charter on Rights and Obligations of States Relating to GNSS Services*
<http://legacy.icao.int/icao/en/assembl/a32/resolutions.pdf>
- ICAO's Global Air Navigation Plan, ICAO Doc. 9750 AN/963
http://www.icao.int/publications/Documents/9750_cons_en.pdf
- Convention on the International Maritime Organization, 289 UNTS 3 (art. 16)
http://avalon.law.yale.edu/20th_century/decado56.asp#1
- IMO Res. 860(2) (1997)
http://www.imo.org/blast/blastDataHelper.asp?data_id=22639&filename=A860%2820%29.pdf
- ITU Constitution and Convention, as amended in 1992, 1994, 1998, 2002, 2006 and 2010
<http://www.itu.int/net/about/basic-texts/index.aspx>

Online resources

- International Committee on Global Navigation Satellite Systems (ICG)
<http://www.unoosa.org/oosa/en/SAP/gnss/icg.html>
- OOSA, *10 Years of Achievement of the United Nations on Global Navigation Satellite Systems*, 2011
http://www.unoosa.org/pdf/icg/2011/11-85461_ICG-ST-55_eBook.pdf

Class 2. GNSS providers and GNSS augmentation



Topics to be covered

- GNSS providers
 - ❖ Global Positioning System (GPS) (United States)
 - ❖ GLONASS (Russian Federation)
 - ❖ Galileo (Europe)
 - ❖ COMPASS/BeiDou (China)
 - ❖ Regional GPS-Aided Geo-Augmented Navigation (GAGAN) (India)
 - ❖ Regional Multifunctional Satellite Augmentation System (MSAS) (Japan)
- GNSS augmentation services
 - ❖ United States Wide Area Augmentation Service (WAAS) and Differential Global Positioning System (DGPS)
 - ❖ European Geostationary Navigation Overlay Service (EGNOS)
 - ❖ System for Differential Corrections and Monitoring (SDCM) (Russian Federation)
 - ❖ COMPASS/Beidou (China)
 - ❖ Multi-function Satellite Augmentation System (MSAS) (Japan)
 - ❖ GPS-Aided Geo-Augmented Navigation (GAGAN) (India)

Learning objective

During this class the students will learn about characteristics of the individual GNSS providers. Students will become familiar with the Global Positioning System (GPS) of the United States, which is the most widely used GNSS system. Students will learn that GPS is a dual-use system that serves both civilian and military users and that it is operated by the United States Air Force and managed by an inter-agency executive board relating to both civil, military and augmentation uses. Students will learn about the Russian GLONASS, which also has a dual function as a civil and military system and which is provided by the Russian Defence Ministry and operated by the GLONASS administration. Students will also become familiar with a third global GNSS provider, Galileo, which is a joint initiative between the European Commission and the European Space Agency and which will become available in 2014. When deployed, Galileo will be interoperable with both GPS and GLONASS and the three systems will operate as a seamless web. Further GNSS operating systems that will be introduced include COMPASS/BeiDou, which is being built by China and which is gradually becoming global; GAGAN, currently being built by India; and MSAT, the regional positioning and navigation satellite system developed by Japan.

Students will learn about the different kinds of GNSS signals available, for example, the Standard Positioning Service, available to all users, and the Precise Positioning Service, available to certain military users. They will also understand the importance of the interoperability of all GNSS providers, how interoperability improves safety, that is, if one system fails, then the other systems are available.

During the class, students will become familiar with GNSS at the regional and local levels, as well as with various GNSS augmentation services that provide users with greater positioning accuracy than is provided by regular GNSS systems.

Augmentation systems are not necessarily linked to any one GNSS system. Upon completion of the class, students will be familiar with a variety of augmentation systems used in different geographical regions, including the United States Wide Area Augmentation Service (WAAS) operated by the Federal Aviation Administration;

the Differential Global Positioning System (DGPS) used by the United States Coast Guard for accurate navigation of ships and for accurate measurements on the surface; the European augmentation system, EGNOS, that currently augments GPS, and which will be available to augment Galileo in the future; the Russian System of Differential Corrections and Monitoring (SDCM); the COMPASS/BeiDou system, which provides greater accuracy in East Asia and which is operated by China; the augmentation system operated by Japan (MSAS); and GAGAN, the augmentation system provided by India, available for the Indian Ocean area.

References and resources

Online resources

- International Committee on Global Navigation Satellite Systems (ICG)
<http://www.unoosa.org/oosa/en/SAP/gnss/icg.html>
- OOSA, *10 Years of Achievement of the United Nations on Global Navigation Satellite Systems*, 2011
http://www.unoosa.org/pdf/icg/2011/11-85461_ICG-ST-55_eBook.pdf
- GPS
<http://www.gps.gov/>
- GLONASS
<http://www.glonass-ianc.rsa.ru/en/>
- ESA Galileo
<http://www.esa.int/esaNA/galileo.html>
- Compass/Beidou
<http://www.beidou.gov.cn/>
- GAGAN
http://en.wikipedia.org/wiki/GPS-aided_geo-augmented_navigation
- OOSA, *Current and Planned Global and Regional Navigation Satellite Systems and Satellite-Based Augmentation Systems*, 2010
http://www.unoosa.org/pdf/publications/icg_ebook.pdf

- WAAS and DGPS
http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/waas/
<http://www.gps.gov/systems/augmentations/>
- EGNOS
<http://www.esa.int/esaNA/egnos.html>
- SDCM
http://www.sdcm.ru/index_eng.html

Class 3. GNSS users



Topics to be covered

- Civilian users of GNSS
 - Air and maritime navigation
 - Launch and operation of space vehicles
 - Disasters
 - Search and rescue operations
 - Land surveys
 - Timing
- Military users of GNSS
- Coordination between GNSS users and GNSS operators

Learning objective

The third class identifies various GNSS users and describes how these users interact with GNSS service providers. Students will learn how GNSS is used for civilian purposes, including in air and maritime navigation, in the launch and operation of space vehicles and tracking of satellites, for early warning of disasters, in search and rescue operations, in land and underwater surveys and for establishing accurate time. Students will also discuss how military users of GNSS rely on it for the same purposes as civilians, in addition to a number of other activities specific to military users, which will be briefly covered during the class.

Upon completion of the class, students will be familiar with the main channels for communication and coordination between GNSS users and GNSS service providers. These coordination mechanisms enable users to inform GNSS service providers when the service is adequate and to give input on how inadequacies could be remedied. Students will become familiar with the Civil GPS Service Interface Committee (CGSIC), established by the United States Department of Transportation to address GPS-related issues together with the GNSS user community; the ICG, which is covered in previous classes; and professional societies such as the Institute of Navigation (ION) and the International GNSS Service (IGS), an organization of GNSS users and providers formed for the purpose of creating the highest standards of GNSS in support of Earth science, research, multidisciplinary applications and education.

References and resources

Online resources

- GPS Applications
<http://www.gps.gov/applications/>
- Civil GPS Service Interface Committee (CGSIC)
<http://www.gps.gov/cgsic/>
- International Committee on Global Navigation Satellite Systems (ICG)
<http://www.unoosa.org/oosa/en/SAP/gnss/icg.html>
- Institute of Navigation
<http://www.ion.org/>

Class 4. Legal framework for GNSS services



Topics to be covered

- International legal framework
 - ❖ Charter of the United Nations
 - ❖ Outer Space Treaty
 - ❖ Registration Convention
 - ❖ Rescue Agreement
 - ❖ Liability Convention
 - ❖ Convention on International Civil Aviation, its annexes and ICAO regulations on GNSS
 - ❖ Convention on the International Maritime Organization and IMO regulations
 - ❖ ITU Constitution, Convention and Radio Regulations
 - ❖ Disasters Charter
 - ❖ Bilateral agreements on interoperability and coordination
- National legal regimes

Learning objective

During this class, students will learn more about the international and national GNSS legal regimes. Aspects of space law which are particularly linked to GNSS will be highlighted.

Students will learn about the right of access to GNSS services and that the ICAO Charter states specifically that States and aircraft “shall have access, on a non-discriminatory basis under uniform conditions, to the use of GNSS services” (article 2). During the class, students will discuss the following questions: Is there a legal right to GNSS services for all users? Should access to GNSS services be conditioned on payment for those services, or should it be free? The ICAO Charter only concerns air navigation uses. Do non-aviation users have right of access to GNSS services? Could the United Nations Security Council adopt a resolution curtailing availability of GNSS services to countries because they violate international peace and security?

Upon completion of the class, students will be familiar with the process of registration of GNSS satellites under the Registration Convention and the issue of possible liability for negligent GNSS services as well as radio and physical interference, space debris damage and other kinds of damage under the Liability Convention. In this regard, the Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space and the Space Debris Mitigation Guidelines of the Inter-Agency Space Debris Coordination Committee (IADC) will be studied.

Students will discuss compliance with the ITU regulations on the use of radio frequencies and allocation of orbital slots. Students will also consider existing bilateral agreements on interoperability and coordination, and national laws and

regulations affecting GNSS. Time permitting, students will discuss availability of GNSS satellites under the Disasters Charter.

References and resources

References

- Charter of the United Nations
<http://www.un.org/en/documents/charter/>
- Outer Space Treaty
<http://www.unoosa.org/oosa/en/SpaceLaw/outerspt.html>
- Registration Convention
<http://www.unoosa.org/oosa/en/SORegister/regist.html>
- Rescue Agreement
<http://www.unoosa.org/oosa/en/SpaceLaw/rescue.html>
- Liability Convention
<http://www.unoosa.org/oosa/en/SpaceLaw/liability.html>
- Convention on International Civil Aviation (1944)
<http://www.icao.int/publications/pages/doc7300.aspx>
- Convention on International Civil Aviation, annex 10
http://www.icao.int/Documents/annexes_booklet.pdf
- ICAO Assembly Resolution A32-19, *Charter on Rights and Obligations of States Relating to GNSS Services*
<http://legacy.icao.int/icao/en/assembl/a32/resolutions.pdf>
- ICAO Global Air Navigation Plan, ICAO Doc. 9750 AN/963;
http://www.icao.int/publications/Documents/9750_cons_en.pdf
- Convention on the International Maritime Organization, 289 UNTS 3
http://avalon.law.yale.edu/20th_century/decado56.asp#1
- IMO Res. 860(2) (1997)
http://www.imo.org/blast/blastDataHelper.asp?data_id=22639&filename=A860%2820%29.pdf

- Space Debris Mitigation Guidelines of the Committee on the Peaceful Uses of Outer Space, General Assembly resolution 62/217, *International cooperation in the peaceful uses of outer space* (Dec. 22, 2007)
http://www.unoosa.org/pdf/gares/ARES_62_217E.pdf
 - Inter-Agency Space Debris Coordination Committee Space Debris Mitigation Guidelines
<http://www.iadc-online.org/>
 - ITU Constitution and Convention, as amended in 1992, 1994, 1998, 2002, 2006 and 2010
<http://www.itu.int/net/about/basic-texts/index.aspx>
 - ITU Radio Regulations, Resolutions and Recommendations, 2008 edition (as amended in 2012)
<http://www.itu.int/pub/R-REG-RR-2008> (2008 edition, not reflecting the 2012 amendments)
 - International Charter on Space and Major Disasters
<http://www.disasterscharter.org/web/charter/charter>
 - United States Code, Title 47, Sec. 309, *Application for license*
<http://uscode.house.gov/>
 - United States Code, Title 51, Sec. 50112, *Promotion of United States Global Positioning System standards*
<http://uscode.house.gov/>
 - United Kingdom, 1986 Outer Space Act
<http://www.legislation.gov.uk/ukpga/1986/38/introduction>
- ### Online resources
- GPS (1994) and GLONASS (1996) Service Commitments to ICAO
<http://www.unoosa.org/pdf/icg/2007/icg2/presentations/38.pdf>
<http://www.gps.gov/policy/cooperation/icao/1994-service-commitment.pdf>
 - National space law database (United Nations Office for Outer Space Affairs)
<http://www.oosa.unvienna.org/oosa/en/SpaceLaw/national/state-index.html>
 - Schematic overview of national regulatory frameworks for space activities (United Nations Office for Outer Space Affairs)
<http://www.oosa.unvienna.org/oosa/en/SpaceLaw/national/schematic-overview.html>

Class 5. GNSS services, uses and current problems



Topics to be covered

- Different classes of GNSS services
 - ❖ Standard positioning
 - ❖ Precise positioning service
 - ❖ National security
 - ❖ Search and rescue
- GNSS as dual-use technology
 - ❖ International codes on arms proliferation
 - ❖ National trade in arms regulations (ITARs)
- Problem areas
 - ❖ Interoperability of the systems of several GNSS providers
 - ❖ Continuity of GNSS signals
 - ❖ Financing
 - ❖ Universal access to GNSS “under uniform conditions”
 - ❖ Sole use
 - ❖ Quality control of GNSS services
 - ❖ Liability for defective GNSS services
 - ❖ User charges
 - ❖ Radio interference with GNSS signals
 - ❖ Orbital slots and radio frequencies

Learning objective

During this class, students will learn more about different classes of GNSS services, including the military and civilian aspects of GNSS, and will discuss some continuing problems related to GNSS services. Students will become familiar with the important difference between the standard positioning service and the more precise kinds of GNSS services, some of which may only be available upon payment of a user charge. Students will also learn about uses of special GNSS search and rescue services. Furthermore, upon completion of the class, students will know that trade in GNSS instruments, both hardware and software, is subject to international and national regulation because of the dual military and civilian uses of GNSS.

During the class, students will discuss the need for continuing international cooperation on establishing interoperability and standardization of the various GNSS services, including augmented services. Upon completion of the class, students will be able to discuss GNSS users’ concerns about having continuing access to GNSS signals, defective and negligent GNSS services, and future possibilities for “sole use” of GNSS navigation and positioning (“sole use” referring to interruptions of the GNSS signal requiring navigation by alternative methods).

Students will learn about opportunities for receiving compensation for damages caused by defective services, and in this regard will also discuss the issue of continued quality control of GNSS services. Legal bases for user charges will

also be of interest to the students. Liability of GNSS providers is an issue of particular interest to GNSS users. Building on their knowledge from class 4, students will discuss whether the Liability Convention applies to defective GNSS service, and whether standard GNSS effectively eliminates GNSS provider liability. The European proposal to accept liability for high-end (precise) GNSS service will be addressed. Students will also consider the requirements and provisions of the UNIDROIT Space Protocol with regard to commercial activities of GNSS satellites.

References and resources

References

- UNIDROIT Space Protocol
<http://www.unidroit.org/english/conventions/mobile-equipment/main.htm#NR4>
- Hague International Code of Conduct against Ballistic Missile Cooperation,
<http://www.hcoc.at/>
- General Assembly resolution 62/20, *Prevention of an arms race in outer space* (Dec. 5, 2007)
http://www.unoosa.org/pdf/gares/ARES_62_020E.pdf

Finally, building on what was discussed in class 1, students will continue their discussion on orbital slots and radio frequencies for communication with GNSS satellites. Time permitting, the main points of Module 4 will be reviewed and students will be invited to discuss any other GNSS issues of interest. Time may also be allotted for discussion about the curriculum as a whole.

Online resources

- Wassenaar Agreement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies
<http://www.wassenaar.org/introduction/index.html>
- Missile Technology Transfer Regime
www.mtcr.info/english
- United States, International Trade in Arms Regulations, 22 CFR, Part 120-130
http://www.pmdtdc.state.gov/regulations_laws/itar_official.html

Follow-up on Module 4

Test your understanding

Class 1. International institutional context for GNSS operators

1. Which international organizations have functions relating to GNSS?
2. Is GNSS solely concerned with aviation?
3. How are GNSS orbital slots and uses of radio frequencies allocated?
4. How do the four global GNSS systems relate to each other?

Class 2. GNSS providers and GNSS augmentation

1. Who provides GPS service?
2. Who provides GLONASS service?
3. Who provides Galileo service?
4. Who provides BeiDou service?
5. What is augmentation of GNSS and what is it used for?

6. What is the nature of WAAS? Where is it available?
7. Who provides EGNOS augmentation service?
8. What are other kinds of augmented GNSS?

Class 3. GNSS users

1. Explain how GNSS users interact with GNSS providers.
2. How are GNSS users organized?
3. Do GNSS users have a right of access to GNSS services?
4. Are GNSS providers liable to GNSS users for defective service?

Class 4. GNSS legal regimes

1. Who pays for the cost of GNSS and for its augmentation?
2. Are GNSS navigation and positioning services always available everywhere?

3. Who is responsible for defective GNSS service?
4. May a State exclude a foreign GNSS provider from operating in its country?

Class 5. GNSS services, uses and current problems

1. What is the difference between standard GNSS and precise GNSS services?
2. How are conflicts between GPS, GLONASS, Galileo and BeiDou resolved?
3. Who controls GNSS reliability?
4. How are interferences with GNSS services handled?

For students interested in further study

The following additional important aspects are recommended:

1. Satellite data in international litigation.

List of instruments of international law (in alphabetical order)

Benefits Declaration	Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries, adopted on 13 December 1996 (resolution 51/122)	Convention on International Civil Aviation (Chicago Convention)	Convention on International Civil Aviation, signed at Chicago on 7 December 1944, entered into force 4 April 1947
Broadcasting Principles	Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting, adopted on 10 December 1982 (resolution 37/92)	Convention on the International Maritime Organization	Convention on the International Maritime Organization, done at Geneva on 6 March 1948, entered into force 17 March 1958
Brussels Convention	Brussels Convention Relating to the Distribution of Programme-Carrying Signals Transmitted by Satellite, done at Brussels on 21 May 1974, entered into force on 25 August 1979	Declaration of Legal Principles	Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space, adopted on 13 December 1963 (resolution 1962 (XVIII))
Charter of the United Nations	United Nations, Charter of the United Nations, signed on 26 June 1945, entered into force on 24 October 1945	International Charter on Space and Major Disasters	Charter on Cooperation to Achieve the Coordinated Use of Space Facilities in the Event of Natural or Technological Disasters, signed on 20 October 2000, entered into force on 1 November 2000
		ESA Convention	Convention for the Establishment of a European Space Agency, concluded at Paris on 30 May 1975, entered into force on 30 October 1980

EU Database Protection Directive	Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data	Moon Agreement	Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (resolution 34/68, annex), adopted on 5 December 1979, opened for signature on 18 December 1979, entered into force on 11 July 1984
Intergovernmental Agreement on the ISS	Agreement Among The Government of Canada, Governments of the Member States of the European Space Agency, the Government of Japan, the Government of the Russian Federation, and the Government of the United States of America Concerning Cooperation on the Civil International Space Station, signed on 29 January 1998	Nuclear Power Sources Principles	Principles Relevant to the Use of Nuclear Power Sources in Outer Space, adopted on 14 December 1992 (resolution 47/68)
ITU Constitution and Convention	Constitution and Convention of the International Telecommunication Union, concluded at Geneva on 22 December 1992, entered into force on 1 July 1994	Outer Space Treaty	Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (General Assembly resolution 2222 (XXI), annex), adopted on 19 December 1966, opened for signature on 27 January 1967, entered into force on 10 October 1967
Liability Convention	Convention on International Liability for Damage Caused by Space Objects (resolution 2777 (XXVI), annex), adopted on 29 November 1971, opened for signature on 29 March 1972, entered into force on 1 September 1972	Registration Convention	Convention on Registration of Objects Launched into Outer Space (resolution 3235 (XXIX), annex), adopted on 12 November 1974, opened for signature on 14 January 1975, entered into force on 15 September 1976

Remote Sensing Principles	Principles Relating to Remote Sensing of the Earth from Outer Space, adopted on 3 December 1986 (resolution 41/65)	UNIDROIT Space Protocol	Protocol to the Convention on International Interests in Mobile Equipment on Matters Specific to Space Assets, adopted on 9 March 2012
Rescue Agreement	Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (resolution 2345 (XXII), annex), adopted on 19 December 1967, opened for signature on 22 April 1968, entered into force on 3 December 1968	Vienna Convention on the Law of Treaties	Vienna Convention on the Law of Treaties, United Nations, <i>Treaty Series</i> , vol. 1155, No. 18232. Done at Vienna on 23 May 1969, entered into force on 27 January 1980
UNESCO Declaration on Satellite Broadcasting	Declaration of Guiding Principles on the Use of Satellite Broadcasting for the Free Flow of Information, the Spread of Education and Greater Cultural Exchange, adopted on 15 November 1972		

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